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results of a former investigation (*Ap. Jour.*, **43**, 1916) for the higher temperatures, as it was then shown that 2300° was a favorable temperature for the bands with either air or oxygen passing through the tube, though the bands were still strong at 2600°. At 2500° to 2600° the more rapid vaporization of the titanium, by increasing the density of the emitting molecules, may have much to do with the great strength of the bands.

Arthur S. King.

Spectroscopic Observations of R Scuti

Espin[1] noted changes in the spectrum of this irregular variable more than thirty years ago when he observed visually that the bands changed considerably in intensity and almost disappeared at times. A series of plates taken at the Lick Observatory in 1903 by R. H. Curtiss[2] showed the presence of bright hydrogen lines at the maximum of light in July of that year.

During the years 1921 and 1922, a number of spectrograms of this star have been secured with the sixty-inch reflector on Mount Wilson. The star is of especial importance because its period ,though irregular to a considerable degree, ranges from 100 to 150 days, and is thus intermediate between the long and short period variables, and because it furnishes an example of the periodic recurrence of the titanium oxide bands in a spectrum which would otherwise be classed as G or K.

The table gives a list of the plates, the dates and the visual magnitudes taken from a curve representing the observations of this star published by the American Association of Variable Star Observers, except for the last three which were derived by extrapolation from the curve with the aid of estimates of the brightness of the star made during the observation at the spectroscope. The fourth column gives the spectral type excluding the bands from consideration, while the fifth gives the strength of the titanium bands on a scale which is used here for subdividing the spectral class M into ten subdivisions depending on the strength of the bands. The next three columns indicate the character and relative intensity of the hydrogen lines on the different dates, *a* referring to absorption lines and *e* to emission lines. The radial velocity is given in the last column.

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[1] *M.,N.* **51**, 12, 1890.

[2] *Lick Observatory Bulletin*, **3**, 41, 1904.

					Hydrogen			
Plate	Date	Mag.	Type	Bands	Hβ	Hγ	Hδ	v
γ10097	1921 Apr. 17	6.8	K2	4	*a*3	*a*5	—	+20.2
c 1082	May 25	5.7	K1	1	*a*2	*a*2	*a*4	+42.6
γ10185	June 11	5.2	G8	none	0	*e*1	*e*1	+43.3
10272	July 14	5.5	G9	none	*e*2	*e*3	*e*2	+36.8
10342	Aug. 11	5.9	G9	1	*e*1	*e*2	*e*1	+49.8
10429	Sept. 10	6.1	K0	2	*a*2	*e*1	*a*5	+50.4
10525	Oct. 11	5.6	G5	none	*e*2	*e*5	*e*3	+48.2
10598	Nov. 7	5.0	G7	none	0	*e*2	—	+34.0
11217	1922 Aug. 3	5.5	G5	none	*a*2	*a*2	*a*5	+33.4
11277	Aug. 31	6.1	G9	1	*a*2	*a*4	*a*6	+32.0
11317	Sept. 28	6.5	K0	3	*a*1	*e*1	—	+55.9
11349	Oct. 4	6.0	K0	1	*a*1	*e*1	—	+42.1

The spectral lines are at all times sharp and well-defined, especially so at maximum phase. The enhanced lines are even stronger than in the spectra of the Cepheid variables. The star is without doubt a giant of the same order of luminosity as the Cepheids. The minima of the light curve are well marked while the maxima are indefinite and irregular. The dates of minima are April 30, 1921, August 26, 1921, April 20, 1022, and about September 28, 1922. It is apparent that the bands are strongest at minimum and that they disappear entirely near the maximum of light while the reverse is true for the bright lines of hydrogen. The variation in spectral type as determined by general characteristics is small and even though the type is more advanced at minimum, it never goes through the later stages of class K. The bands appear at G9 or K0. No other case has come to our attention where the titanium bands appear when the general characteristics of the spectrum indicate a type earlier than K5. Various observers have remarked upon the extreme redness of color especially at minimum. This may be due in part to the high intrinsic luminosity of the star. The bright lines of hydrogen are sharp and show a displacement to the violet corresponding to about 20 km as compared to the absorption lines, as is the case in *o Ceti* and many other long period variables. They are somewhat stronger at the time of increasing light than at the same magnitude when the brightness is diminishing. Hγ is the strongest of the three bright hydrogen lines.

Since the absorption lines are numerous and of very superior quality for measurement, the radial velocities are well-determined. These show a range of over 25 km and are apparently related in some way to the light changes. The mean velocity is about + 40 km. The plate γ 10097, taken near minimum, shows a velocity smaller than the mean while γ 10429 and γ 11317, taken at similar phases, give the largest velocities. The solution of the matter would require a much greater amount of observational material. It seems possible that the velocities may be irregular as well as the light changes.

A. H. Joy.

Ten Stars of Class B Having the Hα Line Bright

Sixth List[1]

Hα has been observed as an emission line in the spectra of the stars in the following list, on photographs made with the 10-inch Cooke refractor and 15° objective-prism, on the dates indicated. The observations marked "100-inch" or "60-inch" were made with single-prism split spectrographs attached to one of the large reflectors, and are of the usual photographic region. On each of these slit spectrograms Hβ appears as a bright line[2] and in some cases Hγ also is bright.

Star	R. A. 1900	Dec. 1900	Spect.	Mag.	Date	Observer	
H. D. 2789	0 26.3	+66 36′	B8	8.2	1920 Aug. 11	H	
					1921 Aug. 14	M	60-inch
					1922 Oct. 11	M	60-inch
H. D. 43285	6 10.3	+6 6	B5	6.0	1922 Jan. 25	H	
					Mar. 13	H	60-inch
					Oct. 8	H	60-inch
H. D. 160095	17 32.9	—33 29	B8	8.7	1921 July 6	H	
					July 7	H	
					July 9	H	100-inch
H. D. 163181	17 49.7	—32 27	Oe5	6.6	1920 Aug. 4-6	H	3 plates
					1921 July 6-7	H	2 plates
					Aug. 12	M	100-inch
					1922 July 11	M	100-inch
H. D. 163454	17 51.1	—31 0	Oe5	7.9	1920 Aug. 4-5	H	2 plates
					1921 July 6-7	H	2 plates
					1922 May 15	M	100-inch

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[1] Previous lists have appeared in these *Publications*, **32**, 336, 1920; **33**, 112 and 264, 1921; **34**, 223 and 294, 1922.

[2] Hβ is usually complex, containing both bright and dark portions.